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NOVEMBER 1980 NUMBER 147

Monthly Report on the Uranium Market

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EXECUTIVE SUMMARY & INDUSTRY OVERVIEW
NUEXCO REPORT 147

The **Exchange Value** decreased again this month to $28.00 per pound U_3O_8, from $28.50 last month. Spot and near term inquiries to sell increased to a total of 7.1 million pounds U_3O_8 equivalent, up from 1.7 million pounds last month. The inquiries come from producers and both utility and non-utility inventory holders. Inquiries to purchase in the same time frame total 1.1 million pounds. Thus pressure on the market continues to be generally downward.

Five Transactions closed this month. One was a long term sale by an Australian seller to a European buyer. The other four were for near term delivery, involving a total quantity of about 1.6 million pounds U_3O_8 equivalent. The **Transaction Value** decreased to $29.00 per pound U_3O_8, down from $30.60 last month.

Nuexco has again recomputed **Apparent Future Consumption** of uranium through 1990, and the results are published in this Report. The current estimate is based on some refinements in the computational methods used. Also, new groundrules were used in estimating additions to installed nuclear capacity. Estimated consumption in the US from 1980 through 1990 decreased by about 90 million pounds U_3O_8 or 21 percent from the previous estimate (Nuexco Report 144). The major reason for the decrease is lower estimated installed nuclear capacity. During the same time period, estimated consumption decreased in the balance of the free world by a cumulative total of about 125 million pounds U_3O_8 through 1990, a 19 percent decrease from the previous estimate.

A new **Supply/Demand Balance** computation also appears in this Report. Due to lower estimated consumption, worldwide commercial uranium inventory levels are forecast to increase from about 250 million pounds U_3O_8 at the start of 1980 to almost 600 million pounds in 1990. Relative inventory levels on a worldwide basis are forecast to remain at about six times annual consumption during the entire decade of the 1980's.

The month's *Topical Essay* discusses the influence that inventory sellers have had on the uranium market in 1980. Included is a tabulation of transactions reported by Nuexco this year; buyers and sellers are classified according to whether they are uranium producers or non-producers.

The *Raw Materials* section describes in detail the Ranger project in Australia.

This Executive Summary may be reproduced for internal distribution.

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MONTHLY REPORT ON THE URANIUM MARKET

November 1980 No. 147

JAMES E. VAUGHAN, *EDITOR*

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URANIUM MARKET

GENERAL

Forecast of Apparent Future Consumption

This Report presents Nuexco's latest forecast of Apparent Future Consumption of U_3O_8. This forecast is substantially different from the previous one, both in the amount of consumption forecast and in the methodology used. Table 1 contains Nuexco's forecast of Apparent Future Consumption as of October 31, 1980. (The term consumption as used by Nuexco refers to U_3O_8 entering the pipeline for fabrication into nuclear fuel). The corresponding installed nuclear electric generating capacities are shown in Table 2.

The levels of consumption presented herein are significantly below the levels presented in Nuexco Report 141, (August, 1980). The most significant re-reduction in absolute terms is in the US. The changes are detailed in Table 3. Table 3 indicates a relatively minor annual difference in consumption as between Report 141 and Report 147 for US reactors currently operational. The big differences are in the category of US reactors under construction. The reasons for these differences are discussed below.

With this Report, Nuexco has introduced some refinements into the method used for forecasting Apparent Future Consumption.

1. *Tails assay* is assumed to be 0.25 percent U_{235}. It was 0.20 percent in past estimates. This change increases estimated consumption by approximately nine percent. This higher tails assay is consistent with practice at enrichment facilities outside the US. It is also consistent with the fact that the optimum tails assay is rising rapidly. The optimum tails assay is now about 0.254 percent U_{235} based on current Exchange Value and the current USDOE AEC prices for separative work.

2. *Capacity factor* for each reactor is forecast according to elapsed time since that reactor's date of commercial operation. Former Nuexco practice was to estimate a capacity factor for each reactor over that reactor's lifetime. The present method is based upon the application of historical capacity factor data to a power curve of the form,

$$y = a\,x^b$$

where:

y = annual capacity factor in percent and

x = years since date of commercial operations.

By applying a simple regression analysis to currently available data, the constants *a* and *b* can be determined.

It is a commonly held belief that capacity factor varies with reactor size. In fact, Nuexco's analysis has indicated that the same simple power curve regression fit is accurate, well within the limits of the analysis, for all US light water reactors of 150 MWe to 1,250 MWe. The same holds true, to a lesser extent, for non-US reactors. For ages of more than 20 years, Nuexco uses a constantly declining capacity factor. Nuexco uses different power curves for different types of reactors and for different regions. The effect of introducing this method of predicting capacity factor is to reduce consumption by a world-wide average of approximately 10 percent.

3. *Reactor physics* improvements are incorporated into the present Nuexco forecast. The two principal motivating forces are:

a. Competition among fuel fabricators, particularly in the market for PWR reload fuel. This has lead to more efficient fuel designs being proposed by the fabricators.

b. The trend toward refueling cycles of eighteen months or longer.

Each of these forces acts to increase the energy content in a given fuel rod. The effect is to reduce the uranium weight in the fuel rod or to increase the average fuel exposure or both. Of course, these changes lead to increases in average levels of enrichment and in the average expected capacity factor. Thus, essentially all important variables in the uranium consumption calculation for reload fuel (and initial core fuel to a lesser extent) will change. These changes in fuel design variables apply to essentially all plants which entered commercial operation after January 1969. Table 4 shows the increases in full exposure incorporated into Nuexco forecasts for PWRs, BWRs and heavy water reactors (HWRs). More efficient fuel design is expected to lead to an overall reduction in uranium consumption of approximately 15 percent between 1981 and 1985 and another 15 percent between 1985 and 1990.

Reduced forecasts of installed nuclear electric generating capacity account for the rest of the changes in Apparent Future Consumption between Report 141 and this Report. This is particularly true of the US. Table 5 is a comparison of installed nuclear capacity forecasts for the year 1990 between Nuexco Report 141 and Report 147. The net effect is a

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Table 1

APPARENT FUTURE CONSUMPTION[1]
(millions of pounds U_3O_8)

BUYER GROUP	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
United States											
Reactors now Operational	16.9	16.3	16.6	17.0	17.2	17.3	17.3	17.2	17.1	17.0	16.8
Now under Construction	0.7	1.6	6.3	10.1	13.2	15.5	18.2	17.9	20.5	23.1	23.5
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
US Subtotal	16.76	20.9	22.9	27.1	30.4	32.8	35.5	35.1	37.6	40.1	40.3
Europe											
Reactors now Operational	12.8	13.4	13.9	14.3	14.6	14.7	14.6	14.5	13.9	13.0	12.5
Now under Construction	4.4	12.2	15.0	21.1	16.2	19.4	20.2	21.7	20.1	20.6	21.5
Now on Order	-0-	-0-	-0-	-0-	-0-	2.2	3.2	8.7	8.4	9.7	8.7
Europe Subtotal	17.2	25.6	28.9	35.4	30.8	36.3	38.0	44.9	42.4	43.3	42.7
Far East[2]											
Reactors now Operational	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.0	2.9	2.8	2.8
Now under Construction	0.2	3.4	3.5	3.5	7.8	8.5	7.4	5.2	4.7	4.6	4.4
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	1.1	2.5	2.0	1.1	1.5
Far East Subtotal	3.8	6.9	6.9	6.8	11.1	11.7	11.6	10.7	9.6	8.5	8.7
Other Free World[3]											
Reactors now Operational	2.1	2.1	2.1	2.1	2.0	2.0	1.9	1.9	1.8	1.7	1.6
Now under Construction	0.6	1.0	3.0	3.8	3.1	2.6	1.0	1.0	3.2	3.1	3.1
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1.6	2.2	0.8	1.4
Other Subtotal	2.7	3.1	5.1	5.9	5.1	4.6	5.9	7.5	7.2	5.6	6.1
FREE WORLD[4] TOTAL	40.4	56.5	63.8	75.2	77.4	85.4	91.0	98.2	96.8	97.8	97.8
WORLDWIDE BREAK-DOWN BY STATUS											
Reactors now Operational	34.5	35.3	36.0	36.7	37.1	37.2	36.9	36.6	35.7	34.5	33.7
Now under Construction	5.9	21.2	27.8	38.5	40.3	46.0	49.8	48.8	48.5	51.7	52.5
Now on Order	-0-	-0-	-0-	-0-	-0-	2.2	4.3	12.8	12.6	11.6	11.6

[1]Computed quantities of U_3O_8 which would be used under the given conditions, to fabricate fuel for loading and reloading reactors operating, under construction or on order as of October 31, 1980. Compiled and computed on a reactor-by-reactor basis, quantities for each reactor are based on specific core characteristics, 0.25% tails assay, no recycling, 24-month lead time for procuring first cores and 18-month lead time for procuring each reload. Where reload schedule is not already known, these estimates assume reloads occur one year after commercial operating date and annually thereafter. Nuexco estimates of individual reactor capacity factors are used.

[2]Japan, Korea, People's Republic of China, Taiwan.

[3]Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian Reactors), Hungary, Poland, Romania, USSR.

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Table 2

NUCLEAR ELECTRIC GENERATING CAPACITY[1,2]
(thousands of MWe—net)

BUYER GROUP	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
United States											
Reactors now Operational	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8
Now under Construction	-0-	3.2	8.2	14.7	21.5	28.2	34.6	41.1	47.1	54.3	60.8
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
US Subtotal	50.8	54.0	59.0	65.5	72.3	79.0	85.4	91.9	97.9	105.1	111.6
Europe											
Reactors now Operational	16.3	16.3	35.1	35.1	35.3	35.3	34.7	34.7	34.1	32.6	31.2
Now under Construction	3.6	13.7	25.6	35.1	41.8	51.6	55.3	59.2	63.3	66.8	66.8
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1.3	4.1	10.9	21.6
Europe Subtotal	39.1	19.3	61.0	70.8	77.1	86.9	90.0	95.2	102.1	110.3	119.6
Far East[3]											
Reactors now Operational	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Now under Construction	-0-	0.5	1.5	4.7	6.7	8.6	14.3	19.0	21.8	21.8	21.8
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1.1	3.0	3.9
Far East Subtotal	16.3	16.8	17.8	21.0	23.0	24.9	30.6	35.3	39.2	41.1	42.0
Other Free World[4]											
Reactors now Operational	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Now under Construction	-0-	0.8	1.7	3.6	7.0	10.1	11.1	11.8	13.1	13.7	13.7
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	2.1	3.6
Other Subtotal	6.5	7.3	8.2	10.1	13.5	16.6	17.6	18.3	19.6	22.3	23.8
FREE WORLD TOTAL	113.0	127.4	146.0	167.4	185.9	207.4	223.6	240.7	258.8	278.8	297.0
WORLDWIDE BREAKDOWN BY STATUS											
Reactors now Operational	109.4	109.2	109.0	109.0	108.9	108.9	108.3	108.3	108.0	106.2	104.8
Now under Construction	3.6	18.2	37.0	58.1	77.0	98.5	115.3	131.1	145.3	156.6	163.1
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	1.3	5	16.0	29.1

[1]Installed as of year end.
[2]Uses Nuexco estimates of commercial operating dates.
[3]Japan, Korea, People's Republic of China, Taiwan.
[4]Excludes Bulgaria, Czechoslovakia, German Democratic Republic, Finland (two Russian reactors), Hungary, Poland, Romania, USSR.

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Table 3

COMPARISON OF NUEXCO ESTIMATES OF US APPARENT FUTURE CONSUMPTION: REPORT 144 (AUGUST 1980) VS. REPORT 147 (NOVEMBER 1980)
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
US Reactors Operational											
Report 144	17.4	17.4	17.4	18.0	18.0	18.4	17.4	17.6	18.3	18.2	17.7
Report 147	16.0	16.3	16.6	17.0	17.2	17.3	17.3	17.2	17.1	17.0	16.8
Annual Difference	1.4	1.1	0.5	1.0	0.8	0.8	0.1	0.1	1.2	1.2	0.9
US Reactors under Construction											
Report 144	0.7	7.5	12.8	17.32	22.2	25.3	30.0	27.1	30.3	27.2	27.6
Report 147	0.7	4.6	6.3	10.1	13.2	15.5	18.2	17.9	20.5	23.4	23.5
Annual Difference	-0-	2.9	6.5	7.1	9.0	9.9	11.8	9.2	9.8	3.8	4.1
US Reactors on Order											
Report 144	-0-	-0-	-0-	-0-	-0-	-0-	0.9	0.3	0.3	3.4	2.0
Report 147	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Annual Difference	-0-	-0-	-0-	-0-	-0-	-0-	0.9	0.3	0.3	3.4	2.0
Total											
Annual Difference	1.4	4.0	7.0	8.1	9.8	10.7	12.8	9.9	11.3	8.4	7.0
Cumulative Difference	1.4	5.4	12.4	20.5	30.3	41.0	53.8	63.7	75.0	83.4	90.4

Table 4

FORECAST IMPROVEMENTS IN FUEL EXPOSURE
(megawatt-days per metric ton uranium)

Reactor Type	1980-1984	1985-1989	1990-1995
BWR	28,100	35,600	17,000
HWR	6,300	7,600	19,750[1]
PWR	33,360	43,900	50,650

[1]Includes enrichment of reloads to an average of 1.20 percent U_3O_8.

Table 5

COMPARISON OF NUEXCO FORECASTS OF INSTALLED NUCLEAR ELECTRIC GENERATING CAPACITY IN THE YEAR 1990
(thousands of megawatts)

	Report 144 (August 1980)	Report 147 (November 1980)	Difference
US	134.9	111.6	-17%
Europe	126.7	119.6	- 6%
Far East	11.2	12.0	+ 2%
Other Free World	23.8	23.8	-0-
TOTALS	326.6	297.0	- 9%

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worldwide decline in installed capacity of about ten percent, but the decline is concentrated heavily in the US.

Nuexco's current forecast of installed nuclear capacity is based upon:

1. In the US, the US Nuclear Regulatory Commission (USNRC) caseload and other institutional constraints on the rate of addition of nuclear capacity;

2. Construction progress to date for individual nuclear plants, and the owner utility's construction experience for conventional as well as nuclear units;

3. The owner utility's financial condition and the estimated likelihood of relief from ratemaking bodies.

Table 6 is a comparison between Nuexco's current forecast of installed capacity and that of the Energy Information Administration (EIA) of USDOE. The Nuexco forecast is below the EIA low case both for the US and for the rest of the world.

Methodology: In order to facilitate interpretation of the results presented, the methodology used in developing the concept of Apparent Future Consumption is summarized below:

1. Forecasts of Apparent Future Consumption are not forecasts of actual uranium demand. Rather, these forecasts comprise a portion of uranium demand more commonly referred to as reactor demand or reactor requirements. As indicators of the amount of uranium which will be needed to fuel the reactors under consideration, these forecasts should be regarded as relatively hard demand in the sense that this portion of demand is quite insensitive to uranium prices. Market demand for the assumed pattern of capacity additions can be higher or lower, depending on user's inventory policies.

2. Factors which can cause demand to exceed Apparent Future Consumption are:

a. Utility buyers plan their procurement strategies to achieve a very high probability of having access to at least enough uranium to meet commitments as they arise;

b. Accelerated reactor construction schedules can advance the dates of uranium need;

c. Buyers may elect to purchase uranium in excess of need, simply to enhance security of supply.

d. Utility obligations to suppliers of fuel cycle services such as conversion, enrichment or fabrication, may require earlier purchase of uranium than a reactor's operating schedule would otherwise indicate.

3. Demand can fall short of Apparent Future Consumption if uranium inventories are reduced in order to fill needs which would otherwise appear as demand.

Table 6

NUCLEAR GENERATION CAPACITY FORECAST FOR 1990
(thousands of megawatts)

	EIA[1] (Low-High)	Nuexco
OECD Countries		
Australia New Zealand	-0-	-0-
Austria Switzerland	2.9-2.9	2.9
Benelux Denmark	6.0-6.0	5.9
Canada	13.1-14.2	11.8
France	38.5-44.2	10.9
Germany	22.5-27.5	18.0
Greece Turkey	-0-	-0-
Italy	3.1-4.3	3.1
Japan	24.5-30.9	27.7
Scandinavia	12.6	10.5[2]
Spain Portugal	9.3-13.2	8.1
United Kingdom Ireland	11.6-13.1	8.2
Subtotal	145-170	138
United States	121-139	112
Non-OECD Countries		
Argentina	1.5-2.1	0.9
Brazil	1.9-3.1	1.9
India	1.9-2.1	1.7
Korea	5.5-7.1	5.1
Mexico	1.3-2.6	1.3
Pakistan	0.1-0.7	0.1
Philippines	0.6-0.6	0.6
South Africa	1.8-2.7	1.8
Taiwan	4.9-6.7	4.9
Yugoslavia	0.6-1.2	0.6
Subtotal	20-30	19
TOTAL	286-339	269

[1]Source: 1979 Annual Report to Congress, Energy Information Administration, Volume 3, pages 31 and 108.
[2]Includes, for purposes of comparison, two reactors fueled by the USSR.

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4. Apparent Future Consumption is based on information available today, subject to frequent revision as the date of consumption draws nearer.

5. Uranium is deemed to have been consumed when it has entered the enrichment-fabrication pipeline for ultimate use in a reactor.

6. Reactor loading is calculated for each reactor type, based on its particular reactor physics.

7. The forecasts assume that:

a. U_3O_8 deliveries for first cores predate commercial operation by two years.

b. U_3O_8 delivery for each reload predates refueling outage by 18 months.

8. Using the assumptions listed above, the consumption for a given reactor can be computed as a function of capacity factor, tails assay and commercial operating date.

9. Reactors fueled by the USSR are excluded from Nuexco's forecasts. Although Soviet bloc reactors account for substantial demand, Soviet participation in uranium trading in the Western market has been negligible and appears likely to remain so.

10. Actual commercial operating dates can vary widely from published dates. Nuexco uses the best information available, much of it from unpublished sources, to prepare its own forecasts of operating dates.

11. These forecasts make no provision for orders not yet placed. Only the consumption associated with reactors operating, under construction or on order are included.

12. The total of approximately 51,000 MWe (net) in Table 2 under the classification of *Reactors Now Operational* in the US is based on 69 reactors. Shippingport and Hanford are not included. Arkansas Nuclear unit 2 is included in the *Reactors Now Operational* category because it was declared commercial on April 25, 1980. Sequoyah unit 1, North Anna unit 2, Salem unit 2 and Farley unit 2 are not included because they have not yet been declared commercial. Consumption forecasts for the latter reactors were included under the category of *Reactors Now Under Construction*. Included in the 69 reactors are Humboldt Bay, and TMI unit 2, even though these plants are indefinitely shut down. Consumption forecasts included in Table 1 for the latter two units reflect their non-operational status.

Forecast of Uranium Production

This Report presents Nuexco's latest forecasts of uranium production for the world outside Communist areas (WOCA). Those forecasts are tabulated in Tables 7, 8 and 9. Table 7 summarizes Nuexco's forecast of US production of U_3O_8 for centers operating or under construction as of October 31, 1980. Table 8 shows estimated world uranium production by region; Table 9 contains the same production estimates segmented according to status of the production center.

Production centers are divided into categories, according to stage of development, as follows:

1. Operating production centers—those which have shipped U_3O_8 in commercial quantities before November 1, 1980.

2. Production centers under construction—those which were being built as of October 31, 1980, and which have an established access to ore reserves. Conventional production centers are included in this category only if mill construction has actually begun.

Each category is further divided, according to source, as follows:

- Conventional milling
- Unconventional recovery methods
  - —Solution mining, including *in situ* leaching and hydraulic mining.
  - —Phosphoric acid by-product recovery.
  - —Heap leaching, including leachings of tailings and copper dumps.

Nuexco presented estimates of world production of U_3O_8 in Report 141. In recognition of the market conditions prevailing at that time, those estimates were based only on facilities which were operating or under construction as of April 30, 1980. The following is excerpted from Nuexco Report 141:

> *. . . In the US, some existing facilities have begun to reduce production. Some can be expected to suspend production within the next one to three years if present trends continue. The estimate of US uranium production presented in this Report is based upon Nuexco's assessment of the probable output of each producer, which in turn is based upon estimated production cost, ore reserves, and sales commitments.*

During the past year, the economics of uranium production have been changing quite rapidly. As spot market prices have dropped, the amount of current US production which has become vulnerable to premature shutdown has increased. In addition, plans for construction of additional facilities have been and

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Table 7

US URANIUM PRODUCTION FORECAST
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	19871	1988	1989	1990
OPERATING:											
Conventional Mills	28.5	21.4	19.1	18.4	16.8	14.3	13.7	13.0	11.4	10.9	10.4
Unconventional Sources	5.6	6.1	6.0	5.6	5.0	4.6	3.6	3.4	3.4	3.4	3.4
Subtotal	34.1	27.5	25.1	24.0	21.8	18.9	17.3	16.4	14.8	14.3	13.8
UNDER CONSTRUCTION (as of 10 31 80)	0.4	1.5	1.8	2.1	2.2	2.2	2.2	2.0	2.0	2.0	2.0
TOTAL (rounded)	34	29	27	26	24	21	20	18	17	16	16

Table 8

WORLD URANIUM PRODUCTION FORECAST[1]
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Australia	2.8	5.8	10.8	10.8	10.8	12.0	15.0	15.0	15.0	15.0	12.0
Canada	18.0	16.4	19.6	19.4	22.2	23.0	25.0	27.0	27.4	27.4	27.4
Niger, Gabon	13.1	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3
France	5.4	7.4	7.7	7.8	8.3	8.3	8.3	8.3	8.3	8.3	8.6
Namibia	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Republic of South Africa	15.4	18.9	19.8	20.4	20.9	21.3	21.7	21.5	21.5	21.4	21.4
Other Nations[2]	1.3	1.4	1.5	2.5	2.7	3.2	3.2	3.2	3.2	3.2	3.2
Non-US Total	66.0	75.2	84.7	86.2	90.2	93.1	98.5	100.3	100.7	100.6	97.9
US[3]	34.2	29.0	26.9	26.1	24.0	21.1	19.5	18.4	16.8	16.3	15.8
TOTAL (rounded)	100	104	112	112	114	114	118	119	118	117	114

[1]Outside Communist Areas.
[2]Includes Argentina, Belgium, Brazil, Chile, Portugal, Spain, and others.
[3]This Report, Table 7.

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URANIUM MARKET

Table 9

WORLD URANIUM PRODUCTION FORECAST[1]
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
OPERATING											
US	34.1	27.5	25.1	21.0	21.8	18.9	17.3	16.1	11.8	11.3	13.8
Non-US	66.0	70.5	71.9	71.9	72.1	69.5	69.9	69.7	69.7	69.6	66.9
Subtotal	100.1	98.0	97.0	95.9	93.9	88.4	87.2	86.1	81.5	83.9	80.7
UNDER CONSTRUCTION											
US	0.1	1.5	1.8	2.1	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Non-US	-0-	1.7	12.8	14.3	16.1	16.6	16.6	16.6	16.6	16.6	16.6
Subtotal	0.1	6.2	14.6	16.4	18.3	18.8	18.8	18.6	18.6	18.6	18.6
PLANNED											
US	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Non-US	-0-	-0-	-0-	-0-	2.0	7.0	12.0	14.0	14.1	14.1	14.1
TOTAL (rounded)	100	104	112	112	114	114	118	119	118	117	114

[1]Outside Communist Areas

continue to be reviewed. At the same time, heightened awareness of rising world inventory levels has increased the likelihood of a prolonged buyers' market.

In response to the rapid adjustments being made by US producers to the increasingly unfavorable economic outlook, Nuexco published in Report 145 a revised forecast of US production. The pace of shutdowns and cutbacks announced since that time has been such as to require a further downward revision in the US uranium production forecast.

Annual US production is expected to decline from the 1979 level of about 37 million pounds U_3O_8 to about 34 million pounds in 1980, about 20 million pounds in 1986 and about 16 million pounds in 1989. The decrease is due to declining ore grades, depletion of orebodies and production cutbacks due to high costs and low prices. It should be noted that Nuexco's forecast of 1980 US production, 34 million pounds, is 15 percent below the USDOE forecast presented at the October, 1980 Uranium Seminar in Grand Junction, Colorado. The difference between the two estimates is largely due to differences in perspective. The USDOE estimate represents the sum of responses for its mid-year marketing survey. Nuexco's estimate is a forecast which endeavors to make allowance for producers' expected reactions to worsening market conditions.

World production for 1979 totalled approximately 99 million pounds U_3O_8, of which non-US production accounted for 62 percent. Table 8 shows the US portion of the world's uranium production declining steadily from its 1979 level of 38 percent.

The continuing decline in spot market prices has begun to have significant effects on uranium production in the rest of the world, albeit more slowly and to a lesser extent than in the US. These effects have so far been limited primarily to commercial producers of uranium, as opposed to captive producers. Some plant expansions included in Nuexco's forecast of Report 141 have been removed from the forecast presented in this Report. Also, some older non-US production facilities can be expected to phase out due to the same pressures of high cost and low grade which affect so many US producers. Nevertheless, world production of uranium is forecast to increase by a total of 15 percent between 1980 and 1990. Decreases in production from the US and some older non-US facilities will be more than offset by production from facilities captive to aggressive national nuclear power programs as well as planned new production from high-grade reserves in Canada and Australia. It should be noted that the forecast presented herein includes, for the first time, forecast production before 1990 from Jabiluka in Australia and Key Lake and Midwest Lake in Canada. This step indicates Nuexco's belief that the economic incentives for developing those deposits are so compelling, espe-

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cially by comparison to the incentives for continuing the development, already under way, of deposits having much less favorable economics, that production from these facilities very likely begin in this decade.

The other important factor contributing to increasing production despite shutdowns and cutbacks by some commercial producers is production arising from facilities captive to aggressive national nuclear power programs. Active promotion of nuclear power by the governments of several nations allows them to use longer planning horizons than their US counterparts. Additionally, much of the important production outside the US is dedicated to attaining and sustaining national self-sufficiency in the nuclear fuel cycle, or at least in nuclear raw materials. For these reasons, much of what might otherwise be excess or economically marginal uranium production outside the US will continue in operation.

The forecast of world production presented herein necessarily reflects some subjective opinions about commercial decisions which will be faced over the next few years by uranium producers. The decisions include whether to:

1. Continue funding some projects already under construction;
2. Expand exploration programs, terminate them or to continue them at some intermediate level;
3. Postpone or terminate planned expansions;
4. Continue uneconomic or marginal mining and milling operations in the hope of near term improvement in the spot market price;
5. High-grade where possible, in effect sacrificing mine life for short-term improvements in average cost of production;
6. Divest themselves of less attractive mining or milling operations;
7. Withdraw altogether from uranium mining and milling.

Those decisions will be based on many factors, but the ultimate outcome of production decisions will most probably be determined by the economics of free market competition except for certain producers captive to electric utilities, and production capacity captive to national nuclear power programs.

Supply and Demand Balance

This section analyzes the resultant balance of uranium supply and demand, following some prefatory comments on definitions and computational ground-rules.

1. With respect to the production forecasts, the critical assumption in this supply-demand analysis is that the forecast production will be sold, even if only for inventory accumulation in a time of apparent excess supply.

2. With respect to US production, the critical element in this supply-demand analysis is the degree to which producers having existing contracts will elect to purchase rather than produce uranium.

3. To the extent that actual annual demand exceeds consumption, inventory is accumulated.

4. It is worth reiterating that forecasts of apparent future consumption take no account of reactors not yet ordered. Consequently, consumption forecasts will understate actual demand by the amount attributable to orders yet to be placed, as well as by inventory purchases.

5. Inventory refers to uranium (U_3O_8, natural UF_6, enriched UF_6) owned by utilities, reactor manufacturers, fuel fabricators and national organizations which procure uranium for commercial purposes. The inventory amounts do not include strategic stockpiles, such as those owned by USDOE. Difficulties in accounting precisely for the variety of possible forms, locations and ownership of uranium inventory necessarily result in some uncertainty in estimating the total world uranium inventory. Nuexco's estimate of worldwide commercial uranium inventory as of the beginning of 1989 is approximately 250 million pounds U_3O_8 equivalent; however, the uncertainty factor of this estimate is ten to fifteen percent. More important is the fact that the primary conclusions of this analysis are not sensitive to beginning inventory variations of ten to fifteen percent.

Table 10 tabulates Nuexco's analysis of the uranium supply and demand balance for the world outside Communist areas. Conclusions which may be drawn from the analysis include the following:

1. Forecast production exceeds forecast consumption in each year through 1990. Supply and demand can be balanced by additions to inventory. In actual practice, if supply exceeds demand over an extended period, the necessary balance would probably result from a combination of inventory purchases and reduced production.

2. The world inventory of approximately 250 million pounds U_3O_8 equivalent at the beginning of

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Table 10

URANIUM SUPPLY-DEMAND BALANCE: WOCA[1]
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
PRODUCTION[2]											
Operating Production Centers	100.1	98.0	97.0	95.9	93.9	88.1	87.2	86.1	81.5	83.9	80.7
Facilities under Construction	0.1	6.2	14.6	16.4	18.3	18.8	18.8	18.6	18.6	18.6	18.6
Planned Facilities	-0-	-0-	-0-	-0-	2.0	7.0	12.0	14.0	14.4	14.4	14.4
Total	100.2	104.2	111.6	112.3	114.2	114.2	118.0	118.7	117.5	116.9	113.7
less											
CONSUMPTION[3]	40.4	56.5	63.8	75.	77.4	85.4	91.0	98.2	97.8	97.8	97.8
equals											
NET INVENTORY INCREASE	59.8	47.7	47.8	37.4	36.8	28.8	27.0	20.5	20.7	19.4	15.9
plus											
BEGINNING INVENTORY	252.1[4]	311.9	359.6	407.4	444.5	481.3	510.1	537.1	557.6	578.3	597.4
equals											
ENDING INVENTORY	311.9	359.6	407.4	444.5	481.3	510.1	537.1	557.6	578.3	597.4	613.3
RELATIVE INVENTORY (years)[5]	6.2	5.5	5.6	5.4	5.7	5.6	5.6	5.5	5.8	5.9	6.1

[1] World outside Communist areas.
[2] This Report, Table 9.
[3] Natural uranium entering enrichment-fabrication pipeline for later use in a reactor. This Report, Table 1.
[4] Nuexco Estimate.
[5] For each year, Relative Inventory equals Beginning Inventory divided by Consumption.

1980 is equal to approximately six years of forward consumption at the 1980 rate. That inventory level is projected to more than double by 1990, reaching almost 600 million pounds U_3O_8 equivalent, which corresponds to approximately six years of forward consumption at the 1990 rate. In fact, the analysis indicates a stable relative inventory level throughout the decade; each year's relative inventory level falls in the range of 5.4 to 6.2 years of forward consumption. The relative inventory levels set forth in Table 10 are much larger than those published in Nuexco Report 115. The increase is partially due to the inclusion of enriched uranium in commercial inventory. The reason for this change in treatment of enriched UF$_6$ inventories is the fact that they have become commercially important for the first time, due to the rapid increase in size of enriched UF$_6$ inventories, especially over the past year, and due to increasing evidence of material being available for sale in the form of enriched UF$_6$. However the major reason for the increase in expected inventory levels is the substantial decrease in the forecast of Apparent Future Consumption published in this Report, compared to earlier Nuexco forecasts.

3. If actual demand is to be sufficient to support production from other production centers planned, but not yet under construction, it may arise from new reactor orders, or from political or national policy considerations. However, it is likely that a major driving force behind any such additional production entering the market would be the displacement of other higher-cost production centers.

Table 11 shows Nuexco's current analysis of the uranium supply and demand balance for the U.S. By treating the U.S. alone, the potential market can be identified for imports and for potential U.S. production centers not yet under construction.

The analysis in Table 11 is of the same basic form described above, but with the addition of an adjustment for *term* U.S. export-import commitments. The current U.S. export-import balance, revised somewhat in this Report, is summarized in Table 12.

URANIUM MARKET

Table 11

URANIUM SUPPLY-DEMAND BALANCE: US
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
PRODUCTION[1]											
Operating Production Centers	34.1	27.5	25.1	21.0	21.8	18.9	17.3	16.4	14.8	14.3	13.8
Facilities Under Construction	0.1	1.5	1.8	2.1	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Planned Facilities	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Total	34.2	29.0	26.9	26.1	24.0	21.1	19.5	18.4	16.8	16.3	15.8
less											
CONSUMPTION[2]											
Reactors Now Operational	16.0	16.3	16.6	17.0	17.2	17.3	17.3	17.2	17.1	17.0	16.8
Now Under Construction	0.7	4.6	6.3	10.1	13.2	15.5	18.2	17.9	20.5	23.4	23.5
Now on Order	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Total	16.7	20.9	22.9	27.1	30.4	32.8	35.5	35.1	37.6	40.4	40.3
plus											
NET IMPORTS (EXPORTS)[3]	(2.5)	0.5	1.5	1.2	2.3	0.6	0.9	1.0	1.1	1.7	1.8
equals											
SUPPLY SURPLUS (DEFICIT)	15.0	8.6	5.5	0.2	(4.1)	(11.1)	(15.1)	(15.7)	(19.1)	(22.4)	(22.7)
plus											
BEGINNING INVENTORY	104.6[4]	119.6	128.2	133.7	133.9	129.8	118.7	103.6	87.9	68.5	46.1
equals											
ENDING INVENTORY	119.6	128.2	133.7	133.9	129.8	118.7	103.6	87.9	68.5	46.1	23.4
RELATIVE INVENTORY[5] (yrs)	6.3	5.7	5.6	4.9	4.1	4.0	3.3	3.0	2.3	1.7	1.1

[1] This Report, Table 7.
[2] This Report, Table 1.
[3] This Report, Table 12.
[4] USDOE, "Survey of United States Uranium Marketing Activity," DOE/RA-0053 July 1980.
[5] For each year, Relative Inventory equals Beginning Inventory divided by Consumption.

Table 12

US IMPORT-EXPORT BALANCE
(millions of pounds U_3O_8)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
IMPORTS											
Annual	5.9	6.1	6.8	5.5	5.1	2.6	2.5	2.5	2.5	2.5	2.5
Cumulative	5.9	12.0	18.8	24.3	29.7	32.3	34.8	37.3	39.8	42.3	44.8
EXPORTS											
Annual	8.4	5.6	5.3	4.3	3.4	2.0	1.6	1.5	1.4	0.8	0.7
Cumulative	8.4	14.0	19.3	23.6	26.7	28.7	30.3	31.8	32.9	33.7	34.4
NET IMPORTS (EXPORTS)											
Annual	(2.5)	0.5	1.5	1.2	2.3	0.6	0.9	1.0	1.1	1.7	1.8
Cumulative	(2.5)	(2.0)	(0.5)	0.7	3.0	3.6	4.5	5.5	6.9	8.6	10.4

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The result of the analysis in Table II is an annual supply surplus or deficit for the US. The annual beginning and ending inventory levels are also tabulated in Table II along with the relative inventory level for each year, in years of forward consumption. Table II indicates an annual US supply deficit beginning in 1984 and growing to an annual level of more than 15 million pounds by 1986. Without additional imports or new US supply, US inventory would decline to a level equivalent to 12 months forward consumption by 1990.

PUBLIC AND GOVERNMENT POLICY

In September, more than 1,500 participants from 75 countries gathered in Munich for the eleventh World Energy Conference. This triennial event, once viewed as a forum where technicians could gather to discuss common problems, has increasingly been politicized. Three national groupings have emerged: the oil producers, the industrialized nations and the developing countries. Differing problems and goals in the energy area reflect their differences in geography, religion and ethnic composition as well as their unique political, economic and national security considerations.

There was general agreement, however, on the scope of the problem. Total world energy demands, even with conservation, are expected to double by the year 2000 and come close to doubling again by 2020, while conventional oil production is expected to peak in 1990 and to decline thereafter. This suggests a vastly larger role for coal, natural gas and nuclear power if economic progress, particularly in the developing countries, is not to be stifled by an energy shortfall.

While coal has been viewed as picking up a substantial portion of expanded energy production, some doubt was cast at the Conference on its ability to live up to such expectations. Increased coal production of the magnitude required will mean enormous expansion in coal industry infrastructure, especially transportation and loading facilities, when at present there are plans neither to finance nor to build this expansion.

Substantial growth in nuclear power was generally viewed by Conference participants as absolutely essential. Nuclear power was viewed as a requirement to meet increased overall energy demands, as well as to displace existing oil and gas electrical generation.

Of particular note at the Conference was an address by Pyotr Nepotozhny, Minister of Power and Electrification of the USSR. He predicted that total electric generating capacity in the USSR in the year 2000 would reach 500,000 MWE, or 2.5 times the current level, and gave highest priority to the development of nuclear electrical generation in the USSR and other Comecon countries.

AFRICA

Uranium production in the Republic of South Africa was 3.9 million pounds U_3O_8 in the third quarter 1980. This is down two percent from the previous quarter, but it represents an increase of 660,000 pounds U_3O_8 or 20 percent above the third quarter 1979. The increase is largely due to plant expansions which have been commissioned over the past year.

South African gold uranium producers normally announce their uranium profitability on a quarterly basis. The nation's largest producing company Vaal Reefs (produced 932,000 pounds U_3O_8 last quarter, or 24 percent of the total) announced profits of R 5.4 million last quarter, down 72 percent from R 19 million in the previous quarter. Vaal Reefs is an Anglo-American Group company, and the lower profits might reflect the uranium stockpiling policy to which the chairman of Anglo-American referred in his recent report to shareholders. He suggested that important quantities of uranium might be stockpiled by South African producers over the next few years, presumably to avoid putting further downward pressure on the near term market.

AUSTRALIA

Prime Minister Malcolm Fraser's coalition government was returned to power in Australia's general election held October 18. Final returns for the House of Representatives show the coalition of the Liberal and National Country Parties holding a 23 seat margin (74-51) over the Labor Party. Despite a net swing of 13 seats to the Labor party (the previous government held a 19-seat margin), the current 23-seat margin in the House of Representatives insures firm control for the Fraser government.

The situation is less clear in the 64-seat Senate where the Liberal-National Country coalition previously held clear control with 35 seats. Thirty-two

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seats were up for election, and while returns are still not final, it is likely that the coalition will hold 32 seats with Labor having 27, the Democrats 4, and one independent. The new Senate does not convene until July 1981, and it is expected that, before then, the necessary compromises will be effected to insure control by the Fraser government forces, even if it lacks a clear majority.

On balance, it appears that the Australian uranium industry can look forward to continued government support for the next three years.

In Nuexco Report 146 reference was made to a debit and credit system in the uranium supply contracts between ERA and its foreign shareholders. It should be noted that this provision is not applicable to the floor prices which are effective in 1985 and later years, but only with respect to the escalated prices payable in 1983 and 1984. Thus, if the escalated prices paid in 1983 and 1984 exceed international long-term market prices in those two years, there is provision for granting partial offsetting credits in later years. However, because ERA can never receive less than the floor price, such credits can only be recouped when (and presumably only to the extent) prices in such later years are higher than the floor prices.

EUROPE

France has increased its nuclear generating capacity 60 percent this year rising form 7,700 MWe in January 1980 to 12,200 MWe at present. The additional 4,500 MWe was provided by the following plants:

Reactor Name	Full Power Date
Dampierre unit 1	May 29, 1980
Gravelines unit 1	July 4, 1980
Gravelines unit 2	August 26, 1980
Tricastin unit 1	July 11, 1980
Tricastin unit 2	August 7, 1980

These five units are capable of producing about 30 billion kilowatt-hours per year, which will offset about 15 million barrels of oil annually.

The Soviet Union reports it will add between 7,000 and 10,000 MWe of nuclear generating capacity each year during the period 1981 through 1985. The new plants will be PWRs of 1,000 MWe nominal capacity. Rumania will soon start construction of the first of six Candu reactors of 660 MWe capacity each. During the first half of 1980, Western Europe ordered nine nuclear plants totaling 8,600 MWe. By contrast, in the US, ten plants totaling 11,000 MWe were canceled during the same period.

UNITED STATES

Nuclear electric power generation in the US totaled approximately 195 million megawatt-hours gross during the first three quarters of 1980. This is down from 206 million in the first three quarters of 1979, and 215 million in the same period of 1978. Thus the effects of the TMI accident continue to plague the industry. Table 13 tabulates monthly and quarterly US nuclear electric generation beginning with the third quarter of 1978. Quarterly nuclear electric generation was gradually increasing through the first quarter of 1979. The TMI accident happened at the end of the first quarter 1979, and the effects on production are apparent in Table 13. US nuclear generation fell from 81.5 million megawatt-hours in the first quarter 1979 to 52.2 million megawatt-hours in the second quarter 1979. (Some decrease would normally have been expected due to off-peak scheduled refueling outages in the spring.) Quarterly nuclear electric output has not approached the pre-TMI high.

The US Nuclear Regulatory Commission (USNRC) has issued the following operating licenses since the TMI accident:

1. Full-power operating license for Virginia Electric & Power Company's North Anna unit 2.
2. Full-power operating license to Tennessee Valley Authority's Sequoyah 1 unit.
3. Low-power testing license for Public Service Electric & Gas Company's Salem unit 2.
4. Low-power testing license for Alabama Power Company's Farley unit 2.

The USNRC has published (45FR 65521) the final regulations on Uranium Mill Tailings Licensing and the Final Generic Environmental Impact Statement on Uranium Milling. One major US producer has recently commenced litigation to attempt to overturn the USNRC's new tailings requirements.

Recent months have seen substantial revisions in the historical data of the US Bureau of Labor Statistics (BLS) industry employment series. Revisions in the Average Hourly Earnings data reprinted by Nu-

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Table 13

US NUCLEAR ELECTRIC POWER GENERATION
(millions of megawatt-hours, gross)

		Monthly	Quarterly
1978	July	26.2	
	August	27.3	
	September	23.4	76.9
	October	24.6	
	November	26.3	
	December	27.4	78.3
1979	January	29.2	
	February	27.3	
	March	25.0	81.5
	April	19.3	
	May	15.8	
	June	17.1	52.2
	July	22.5	
	August	26.1	
	September	23.2	71.8
	October	22.3	
	November	20.3	
	December	21.9	64.5
1980	January	21.1	
	February	20.8	
	March	21.2	63.1
	April	19.6	
	May	19.6	
	June	19.4	58.6
	July	22.1	
	August	15.6	
	September	24.8	72.8

exco are tabulated in the statistical data section of this Report. These data supersede those published in Nuexco Report 139.

The data revisions have arisen because the US BLS periodically adjusts its industry employment series to more recent bench marks to correct for sampling variability and for changes in industrial activity. Beginning with the July 1980 issue of "Employment and Earnings," published by the BLS, all data are adjusted to the latest benchmark available, March 1969, and are subject to revision from that point forward with the advent of the next benchmark scheduled for publication of mid-1981.

TRANSACTIONS

Five sales transactions are reported this month. A US producer sold from 101,000 to 300,000 pounds U_3O_8 to a US utility for delivery in late 1981. A US producer sold a small lot under 50,000 pounds to a US producer for immediate delivery. A long term transaction was concluded between an Australian producer and a European utility with deliveries commencing in 1982 and stretching over 15 years. A European organization sold between 101,000 and 300,000 pounds to a European utility for immediate delivery. Finally, a US nuclear contractor sold between 601,000 and 1,000,000 pounds U_3O_8 equivalent as UF_6 to a US utility for delivery in 1981.

PRICING

This month's market activity indicates that prices are still softening, since it is necessary to cut prices to move material. Accordingly, the Exchange Value declined again to $28.00, from $28.50 last month.

Market pressures seem to be all in the downward direction. Near term demand is not only thin, but largely discretionary, since it consists mainly of producers interested in buying rather than making, plus a few utilities purchasing for inventory. Total uranium available for sale (see Market Opportunities section of this Report) and delivery over the next year is about 7.4 million pounds U_3O_8 equivalent, of which about 5.5 million pounds is from inventory holders. The total of inquiries to buy over the next year is 4.1 million pounds. Supply is still much greater than demand, as it has been over the past several months. This imbalance has lead to aggressive price competition among sellers.

Activity has become focused on the longer term. It is now possible for a buyer to receive multiple offers from US, Canadian, and Australian sellers in response to inquiries for intermediate and long term supply. Several US buyers are now in the process of evaluating long term offers.

CONVERSION

Inquiries to sell conversion services on the secondary market over the next year currently total about 4.5 million pounds U in UF_6. Some of these inquiries come from uranium inventory holders interested in selling uranium inventory. These sellers

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have found there is more interest among uranium purchasers if the form of the material being marketed is concentrates, rather than UF_6. This is because the potential buyers are often uranium producers, which, if they purchase at all, usually must purchase uranium in the form of concentrates since their preexisting delivery obligations are for concentrates. Also, utility buyers are normally interested in purchasing uranium in the form of concentrates rather than UF_6 because they usually have preexisting conversion obligations which cannot be met if they buy UF_6. This helps explain the selling pressure on the secondary conversion market.

Thus it appears that the conversion market is now multi-faceted. In the longer term market, it appears that conversion services are available only from the primary conversion contractors. The price in the longer term primary market is determined by separate forces from those affecting the near term, secondary market. The near term market has two major forces influencing it. The first is the uranium inventory holders which own UF_6 and want to sell it, but can only sell the inventory if it is in the form of concentrates. This group is interested in selling conversion services in order to, in effect, *deconvert* their UF_6. The deconversion would take the form of a swap of UF_6 for concentrates, with a consideration paid for the conversion services as agreed to by the parties. The price at which conversion services would be available for sale by these sellers is largely determined, not by the value of the conversion, but by the pressure on the inventory holder to sell the uranium. Thus the driving force on conversion price in this secondary market is indirectly determined by uranium supply and demand.

There is another, currently less important facet, of the conversion market. A few secondary sellers of conversion services are interested in selling only conversion services; there is not pressure to sell uranium driving the conversion sale. These sellers have, however, been relatively unimportant recently because downward pressure on the near term secondary conversion market from potential uranium inventory holders has resulted in very low conversion prices in this market. This situation can be expected to continue as long as uranium inventory holders remain active as sellers, since most inventory is held in the form of UF_6.

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NUEXCO

TOPICAL ESSAY

THE EFFECT OF INVENTORY SALES ON THE URANIUM MARKET IN 1980

In the first ten months of 1980 uranium prices dropped significantly. As measured by Nuexco's Exchange Value this decline has amounted to $12.75, from $40.75 per pound U_3O_8 as of December 31, 1979 to $28.00 per pound U_3O_8 as of October 31, 1980.

The primary factor in this price decline is, of course, the supply demand imbalance. Table 10 of this Report indicates that the 1980 beginning of year world inventory level was about 250 million pounds U_3O_8 equivalent. This represents about six years of world consumption at current rates. This inventory level has increased during 1980 and is expected to continue to increase during the next several years. In addition there is persuasive evidence of the existence of enormous uranium resources worldwide. Thus, buyers view the possibility of any uranium shortage in the coming decade as very remote.

However, the precipitous decline in the Exchange Value during the past ten months cannot be attributed only to a sudden awareness of a supply demand imbalance. It is apparent that the price decline has been hastened by other market factors, one of which is the availability for sale of uranium inventory.

Table 14 is a tabulation of spot and near term sales transactions reported in the Nuexco Monthly Report during 1980. Table 15 contains intermediate and long term transactions reported by Nuexco during the same time period. Although the intermediate and long term transactions involved six times as much material as the spot and near term transactions, it is these shorter term sales which determine the current market price. This is because most of the longer term transactions have pricing provisions which are related to either production cost, or market price at the time of delivery, often subject to a floor price. The nearer term contracts, on the other hand, tend to be fixed price arrangements.

Table 14 indicates that producers have been more important than non-producers as sellers in the near term market, both in terms of number of transactions and quantity of material sold. However, there have been a significant number of sales by nonproducers, sales amounting to more than one-third of the spot and near term material delivered. This selling pressure has persisted, as indicated by the fact that of the 7.4 million pounds U_3O_8 available for sale and delivery within the next year (see Market Opportunities Section of this Report), about 5.5 million pounds is being offered by non-producers. The market activity of inventory holders has thus served as sort of a catalyst in speeding a price drop that probably would have happened as a logical reaction to fundamental market pressures. In the longer term, inventory sales might lead to an overreaction, pushing prices below the level they would have otherwise reached.

The reason that uranium inventory holders have had these effects on the market stems from uranium's unique characteristics as a commodity. With most commodities, consumer inventories act as a *surge tank*. Market prices vary in a roughly cyclical pattern, and inventories react accordingly. As supply grows relatively short, the market price increases, and buyers will either reduce inventory levels or use substitute materials. Similarly, when supply becomes abundant and the market price declines, buyers frequently will choose this time to increase inventories as well as increase the use of the material. Such action on the part of buyers will tend to increase demand, the market price will eventually rise and the cycle will start again.

Uranium deviates in several important respects from this standard model. The first is that uranium is a single purpose commodity with no use other than for electrical power generation. No matter how low the price of uranium drops, the only commercial users of uranium will be electric utilities. Similarly, once a nuclear plant is in place there is no substitute for uranium, no matter how high the price. Thus there is no cross-elasticity of demand for uranium, over the short term. This constrains the supply demand relationship because as the price goes up and down there are relatively few additions to or departures from the consumer group. Thus demand for uranium is relatively inelastic over the short term.

Uranium deviates from the standard model in a second important respect, that is the sheer magnitude of the current inventory levels. Earlier uranium commitments combined with later reactor delays and cancellations have caused many utilities to accumulate far more uranium than had been anticipated or that any logical inventory policy would dictate. Inventories, moreover, are dispersed. Several US utilities have the capability to offer in excess of five million pounds for sale on the near term market. When inventories reach these levels, not only does the market price drop in response to decreased demand,

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TOPICAL ESSAY

Table 14

SPOT AND NEAR TERM[1] SALES TRANSACTIONS REPORTED IN THE NUEXCO MONTHLY REPORT DURING 1980[2]
(number of transactions and thousands of pounds U_3O_8 involved)

	Buyer				
Seller	US Producer	US Non-Producer	Non-US Producer	Non-US Non-Producer	Total
US Producer[3]	6 (850)	7 (1,111)	—	7 (1,161)	20 (3,452)
US Non-Producer[4]	6 (1,055)	4 (1,176)	—	3 (385)	13 (2,616)
Non-US Producer	—	1 (750)	2 (370)	3 (750)	6 (1,870)
Non-US Non-Producer	—	1 (210)	1 (210)	1 (28)	3 (448)
TOTALS	12 (1,905)	13 (2,677)	3 (580)	14 (2,324)	42 (8,386)

[1]Near term means delivery within one year after contract signature.
[2]Nuexco Reports 138 through 147.
[3]"Producer" means companies directly involved in mining uranium.
[4]"Non-producer" includes utilities, government agencies, fuel fabricators and others not directly involved in mining uranium.

Table 15

INTERMEDIATE[1] AND LONG TERM[2] SALES TRANSACTIONS REPORTED IN THE NUEXCO MONTHLY REPORT DURING 1980[3]
(number of transactions and thousands of pounds U_3O_8 involved)

	Buyer				
Seller	US Producer	US Non-Producer	Non-US Producer	Non-US Non-Producer	Total
US Producer[4]	—	2 (3,430)	—	4 (4,110)	6 (7,540)
US Non-Producer[5]	—	—	—	—	—
Non-US Producer	—	1 (1,500)	—	6 (30,640)	7 (35,140)
Non-US Non-Producer	—	—	—	—	—
TOTALS	—	3 (7,930)	—	10 (34,750)	13 (42,680)

[1]Delivery extends more than one year and less than five years after contract signature.
[2]Delivery extends more than five years beyond contract signature.
[3]Nuexco Reports 138 through 147.
[4]"Producer" means all companies directly involved in mining of uranium.
[5]"Non-Producer" includes utilities, government agencies, fuel fabricators, and others not directly involved in mining uranium.

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TOPICAL ESSAY

but the situation is aggravated by the perceived potential and actual availability of supply from inventory holders. Even a small group of utilities, should their decisions to sell coincide, could create an overwhelming near term supply imbalance with a further significant impact on the market price.

The final deviation from the standard model is that uranium is a commodity which passes commercially directly from producer to end user. With many commodities, there are intermediary firms which purchase the material, process it, and sell it to the end user or another intermediary firm. This tends to increase the number of available *surge tanks* in which inventory can be held. In the uranium industry, where title to the material generally passes directly to the end user, there is no cushioning effect of intermediate owners of the material, thus excess supply is quickly felt in terms of large inventories in the hands of consumers. Further, because producers sell uranium directly to end users, the potential for end users to then sell back to producers is increased due to the preexisting buyer seller relationships.

These factors in aggregate make it both possible and in some cases very practical for inventory holders to sell, or at least consider selling material. The fact that a significant number of holders have so opted helps to explain why inventory holders have had a hastening effect on the decline in the market during 1980.

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THE RANGER PROJECT

The Ranger Project is located about 200 kilometers east of Darwin, Northern Territory, on the east flank of the Pine Creek Geosyncline. It was initiated as an exploration venture owned by EZ Industries Ltd. and Peko-Wallsend Ltd. The two companies operated under the name of Geopeko Ltd. during the initial drilling on the Ranger No. 1 and No. 3 orebodies. A managing company, Ranger Uranium Mines Pty., Ltd., was later formed to continue the orebody evaluation. In 1975, the Australian Atomic Energy Commission (AAEC) agreed to provide 72½ percent of the capital required for continuing project exploration and development in return for a 50 percent interest in the project. Peko and EZ agreed to finance the remaining 27½ percent and each would retain a 25 percent interest. Property evaluation continued under the direction of Ranger Uranium Mines.

Project ownership essentially remained unchanged until September 30, 1980, when the joint venturers assigned their interest in the Ranger Project for cash consideration and stock in a newly formed company—Energy Resources of Australia, Ltd. (ERA). The terms of the transaction were described in detail in Nuexco Report 146.

Production from the Ranger project is scheduled to begin in late 1981 at a rate of 3,000 tonnes U_3O_8 per year. Figure 1 is a location map of the Ranger Project area showing the relationship to other uranium deposits within the Pine Creek Geosyncline. Figure 2 is a recent aerial photograph of the Ranger site.

History

The East Alligator River region became of interest to prospectors following an announcement by the Australian Bureau of Mineral Resources in 1968 that Archean and Lower Proterozoic rocks had been tentatively identified in the area. This indicated a geologic and possible mineralogic analogy to that of the uranium-rich Rum Jungle region on the west side of the Pine Creek Geosyncline. Consequently, prospecting of the East Alligator River region began almost immediately.

Geopeko Ltd. was one of several companies to obtain an authority to prospect in the area in 1968. Due to the lack of rock outcroppings throughout the region, aerial surveys utilizing radiation detection instruments became the favored exploration technique. In early 1969, Noranda (Australia) Ltd. located several relatively intense radioactive anomalies within the limits of its own permit area and at least one important anomaly on the Geopeko permit. Follow-up evaluation of the anomalies by ground crews from each company resulted in the eventual discovery of the Ranger No. 1 and No. 3 orebodies by Geopeko and the Koongarra deposit by Noranda.

Geopeko eventually outlined six radiometric anomalies within about 6,000 meters along a north-south trend near the southern limits of their permit area. A percussion and diamond drill program was initiated on anomalies No. 1 and No. 3. A total of 43 holes was drilled on 100 meter spacing. Uranium mineralization was encountered at the surface and to a depth of about 200 meters. In October 1970, the Geopeko joint venture announced the discovery of indicated uranium resources totaling 70,000 tonnes of contained U_3O_8. Figure 3 is a radiometric anomaly map of the Ranger area showing the anomaly relationship of the No. 1 and No. 3 orebodies. Evaluation of the remaining anomalies has yet to be completed.

Diamond drilling was resumed on the No. 1 orebody in 1971 on a hole spacing of 50 meters. A number of cores were taken from different ore zones to determine ore characteristics for future mining and milling. The orebody was eventually expanded to the approximate dimensions of 400 meters in length, 225 meters in width and 145 meters in thickness. Estimated ore reserves of No. 1 orebody as of January 22, 1980, assuming a mine cutoff grade of 0.10 percent U_3O_8 are 15,870,100 tonnes ore at an average grade of 0.33 percent U_3O_8. Total uranium content is 52,878 tonnes U_3O_8.

The second phase of diamond core drilling was initiated on the No. 3 orebody in October 1971, on a hole spacing of 100 meters. By late 1972, drilled out reserves of approximately 31,000 tonnes U_3O_8 had been estimated for the orebody. Evaluation has since continued intermittently and orebody dimensions now average approximately 650 meters in length, 400 meters in width and 100 meters in depth. Ore reserves for one No. 3 orebody as of on January 22, 1980, assuming a cutoff grade of 0.05 percent U_3O_8, are estimated at 28,786,000 tonnes ore at an average grade of 0.20 percent U_3O_8. Total uranium content of No. 3 orebody is 58,000 tonnes U_3O_8, however approximately 15,000 tonnes of the total are classified as *possible* ore.

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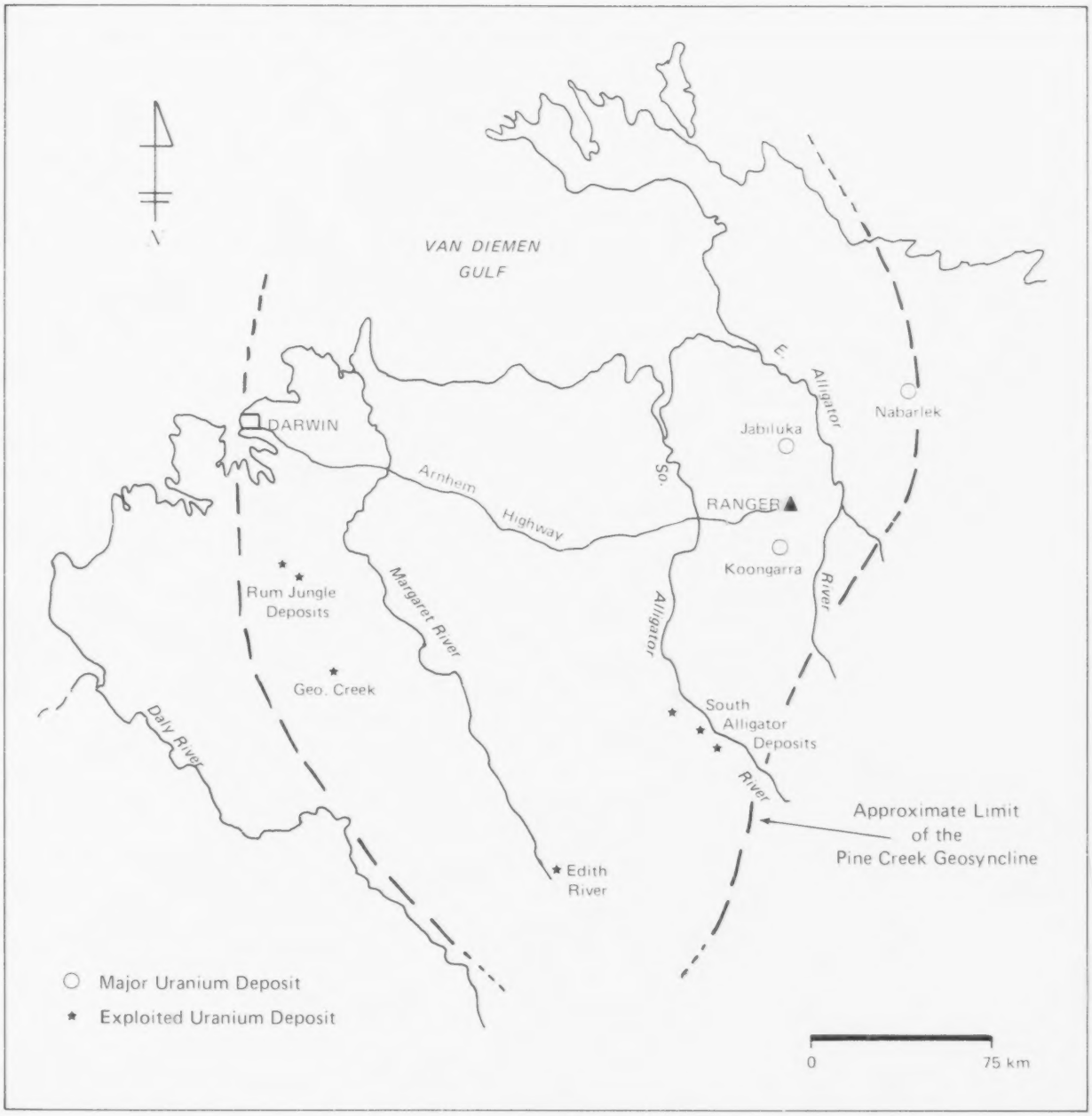

Figure 1
LOCATION MAP OF THE RANGER DEPOSIT AND OTHER URANIUM DEPOSITS WITHIN THE PINE CREEK GEOSYNCLINE, NORTHERN TERRITORY, AUSTRALIA

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Figure 2
AERIAL VIEW OF THE RANGER SITE. THE OREBODY IS IN THE LEFT FOREGROUND. THE MILL IS ON THE RIGHT.

Geology

The Pine Creek Geosyncline represents the principal geologic feature of the entire region. Archean and Lower Proterozoic rocks have been moderately folded across the north-south trending synclinorium,[1] which extends from the Rum Jungle area in the west to the East Alligator River area in the east. The major uranium orebodies in the Northern Territory, Ranger No. 1 and No. 3, Koongarra, Jabiluka and Nabarlek, all occur along the east flank of the synclinorium structure (see Figure 1).

The Archean rocks in the East Alligator River area consist of granite, schist and gneiss belonging to the Nanambu Complex which has been age dated at 2,500 to 1,800 million years (m.y.). Locally, this is referred to as the Footwall Sequence. The Footwall consists primarily of quartz-mica schist and sericite-quartz-feldspar gneiss which developed during a period of intense metamorphism at about 1,800 m.y.

The Footwall Sequence is unconformably overlain by the Lower Mine Sequence which occurs at the base of the Cahil Formation and is the earliest sedimentation of Lower Proterozoic Age. It is, in turn, overlain by the Upper Mine Sequence and the Hanging Wall Sequence to end deposition of the lower Cahill Formation. The upper member of the Cahill Formation consists of 2500 meters of fine grained sandstone and mica-quartz schists. It is in turn, overlain by the Nourlangia Schist, the youngest Lower Proterozoic meta-sedimentary unit in the district.

Each depositional sequence was intensely metamorphosed during renewed igneous activity consisting of intrusions of granite and pegmatite and basic dikes, all considered to be related to the Nanambu basement complex. Evidence of brecciation occurs along formation contacts, fault and fracture zones and alteration collapse features. Igneous activity and metamorphism began at about 1,800 m.y. and ended

[1]A synclinal structure of regional extent wherein the formations have been folded repeatedly across the width of the structure.

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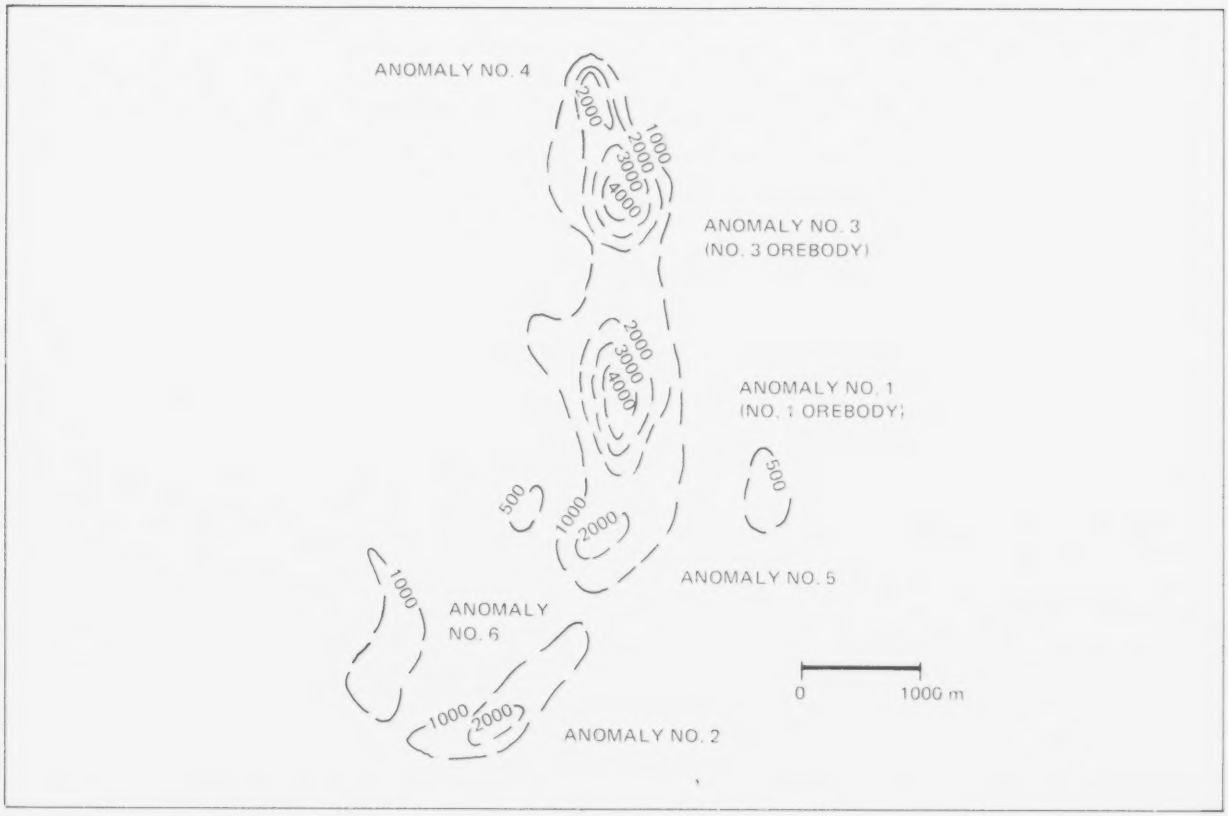

Figure 3
OUTLINE OF AERIAL RADIOMETRIC SURVEY, CONTOURS OF TOTAL COUNT

about 1,650 m.y.

The three lower units of the Cahil Formation primarily consist of intercalated dolomite, chert, quartzite and a series of chlorite, graphite and sericite biotite schists. The principal host rock for uranium mineralization is the chlorite and sericite biotite schist series. The formational units are described as follows, beginning with the lowest unit: *Lower Mine Sequence:* This unit is about 250 meters thick. The lower portion consists of massive fine to medium grained magnesite dolomite marble. The middle portion which is less than 20 meters thick, is the main uranium-bearing zone in the unit and consists of chlorite-sericite schist. The upper part is predominantly dolomitic marble with chlorite lenses. *Upper Mine Sequence:* The unit is about 150 meters thick consisting of biotite-quartz-feldspar schists and dolomitic marble and biotite-quartz schist with sericite lenses and stringers, all of which have been subjected to chloritization. The chloritized biotite-quartz-feldspar schists are the main host rocks for uranium mineralization in both Ranger orebodies. Carbonaceous material is common in the lower portion.

Hanging Wall Sequence: The unit is up to 10 meters thick and consists of coarse mica-feldspar-quartz schist and coarse grained sericite-chlorite schists with disseminated magnetite. Uneconomic uranium mineralization occurs in this unit.

The Lower Proterozoic was further metamorphosed and brecciated by intrusions of coarse quartz-feldspar-tourmaline pegmatites and dolerite dikes that show

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chloritization in association with uranium mineralization. This is the latest stage of intrusive action. It is considered to have taken place during Carpentarian time and is Middle Proterozoic in age.

Uranium Occurrences

All uranium deposits in the East Alligator River district, including the Ranger deposits, are considered to be stratebound deposits in the lower member of the Cahill Formation of Lower Proterozoic Age. Mineralization is always closely associated with the chloritic zones in the Upper Mine Sequence and the Lower Mine Sequence. The chlorite occurs as replacement of the mica minerals—biotite, muscovite and sericite—in all deposits except Nabarlek. Uranium occurs primarily with quartz-biotite-sericite-chlorite schists. All orebodies except Nabarlek are adjacent to massive bedded dolomite and or magnesite formations.

Ranger No. 1 orebody is primarily limited to chloritized biotite-quartz-feldspar schists in the Upper Mine Sequence; a small tonnage occurs in chloritic veins in a silicified carbonate of the Lower Mine Sequence at the very base of the Cahill Formation. The upper portion of the orebody occurs in a highly oxidized zone from the ground surface to a depth of about 35 meters. The oxidized zone is considered to be at the unconformable contact between the Lower Proterozoic and the overlying Middle Proterozoic.

About two million tonnes of ore in the Ranger district occurs in the oxidized zone. Secondary uranium minerals present in the oxidized zones consist of saleeite, sklodowskite, metatorbernite and a little gummite. Mineralization in the lower unoxidized portion of the orebody consists of vein-type and disseminated pitchblende, primarily within zones of brecciation and fractures associated with chlorite schists. Over 13 million tonnes of ore occurs in the unoxidized zone. The orebody contains gold in trace amounts, usually associated with other gangue minerals such as quartz, pyrite, chalcopyrite and galena, however, all such minerals occur in subeconomic concentrations. The dikes that intruded the Lower Proterozoic rocks during Carpentarian times are essentially unmineralized except along shear and fracture zones. Figure 1 is an east-west generalized geologic section through the No. 1 orebody. Note that the large portion of ore occurs in the Upper Mine Sequence (UMS) compared to ore in the Lower Mine Sequence (LMS), and that faulting was a controlling factor to the placement of mineralization.

The geology and mineralogy of the No. 3 orebody is similar to the No. 1 orebody. Essentially all ore occurs near the base of the Upper Mine Sequence in chlorite schists, directly above a thick chloritic carbonate zone. An insignificant amount of mineralization occurs at the base of the Lower Mine Sequence, in a brecciated chloritic carbonate host. The Carpentarian dikes and faulting common to the No. 1 orebody are almost nonexistent in the No. 3 orebody. The few dikes identified are not mineralized. Figure 5 is an east-west generalized geologic section through the No. 3 orebody. All ore is confined to the lower portion of the Upper Mine Sequence (UMS).

Mineralization in the No. 3 orebody is the same as No. 1 Orebody. The same suite of minerals occur in the oxidized zone which is 20 to 30 meters thick. There is evidence of secondary uranium mineralization trailing along the upper ore contact throughout the unoxidized zone. Pitchblende is the only important uranium mineral in the unoxidized portion of the orebody.

Ore Genesis

A favored theory regarding ore genesis suggests that the deposits formed by remobilization of uranium into favorable traps created by structural and solution activity. The primary trap environment for all deposits in the district is zones of brecciation and fracturing. The original source of uranium is considered to be the Archean granites which contain a higher uranium content than is normal in other granites. The uranium was remobilized during the structural and metamorphic activity at about 1,800 m.y. The mineralization was deposited with the overlying Kombolgie Sandstone as it was deposited on the Cahill surface after an extensive period of erosion which removed most of the Upper Cahill and Nourlangie Formations. Eventually, minor structural activity, and erosion of the Kombolgie Sandstone, resulted in another epoch of remobilization of the uranium which was re-precipitated in the favorable traps of the Lower Cahill Formation about 900 to 500 m.y. ago. According to this theory, the uranium mineralization is epigenetic.

A second theory of origin suggests that uranium mineralization is syngenetic, i.e., the uranium was deposited contemporaneously with deposition of Lower Proterozoic rocks. It was subsequently remobilized and reconcentrated by hydrothermal ac-

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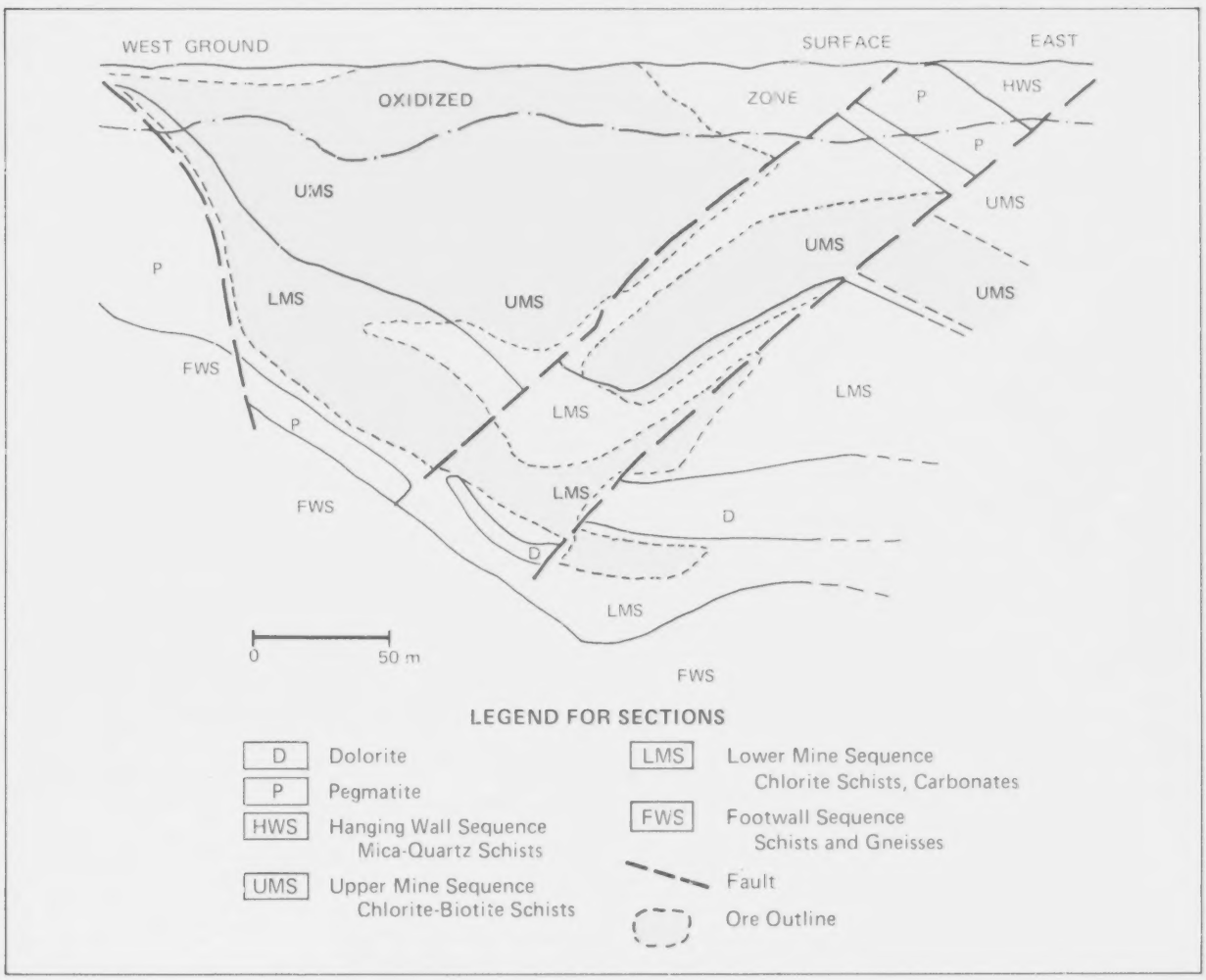

Figure 4
GENERALIZED GEOLOGIC SECTION THROUGH NO. 1 OREBODY

tivity associated with structural and metamorphic events about 1,800 m.y. Residual uranium in Archean rocks and the Lower Mine Sequence may have experienced a second phase of remobilization about 900 to 500 m.y. ago to complete formation of the deposits as they are known today.

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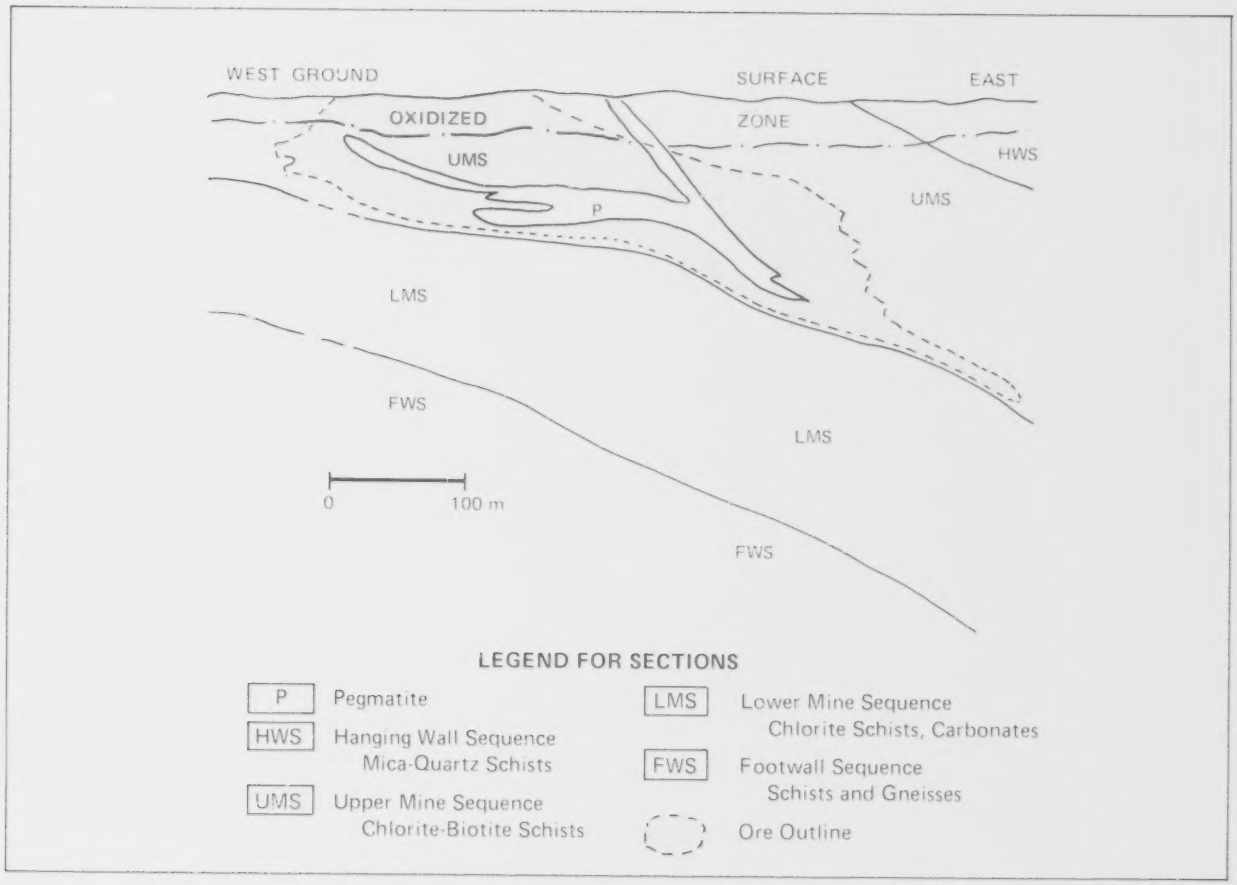

Figure 5
GENERALIZED GEOLOGIC SECTION THROUGH NO. 3 OREBODY

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STATISTICAL DATA

EXCHANGE VALUE—$28.00 lb U_3O_8
Determined as of October 31, 1980

Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

Derivation

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

TRANSACTION VALUE
Determined as of October 31, 1980

$ lb U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
29.00	3.2	11	3

Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U_3O_8 are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

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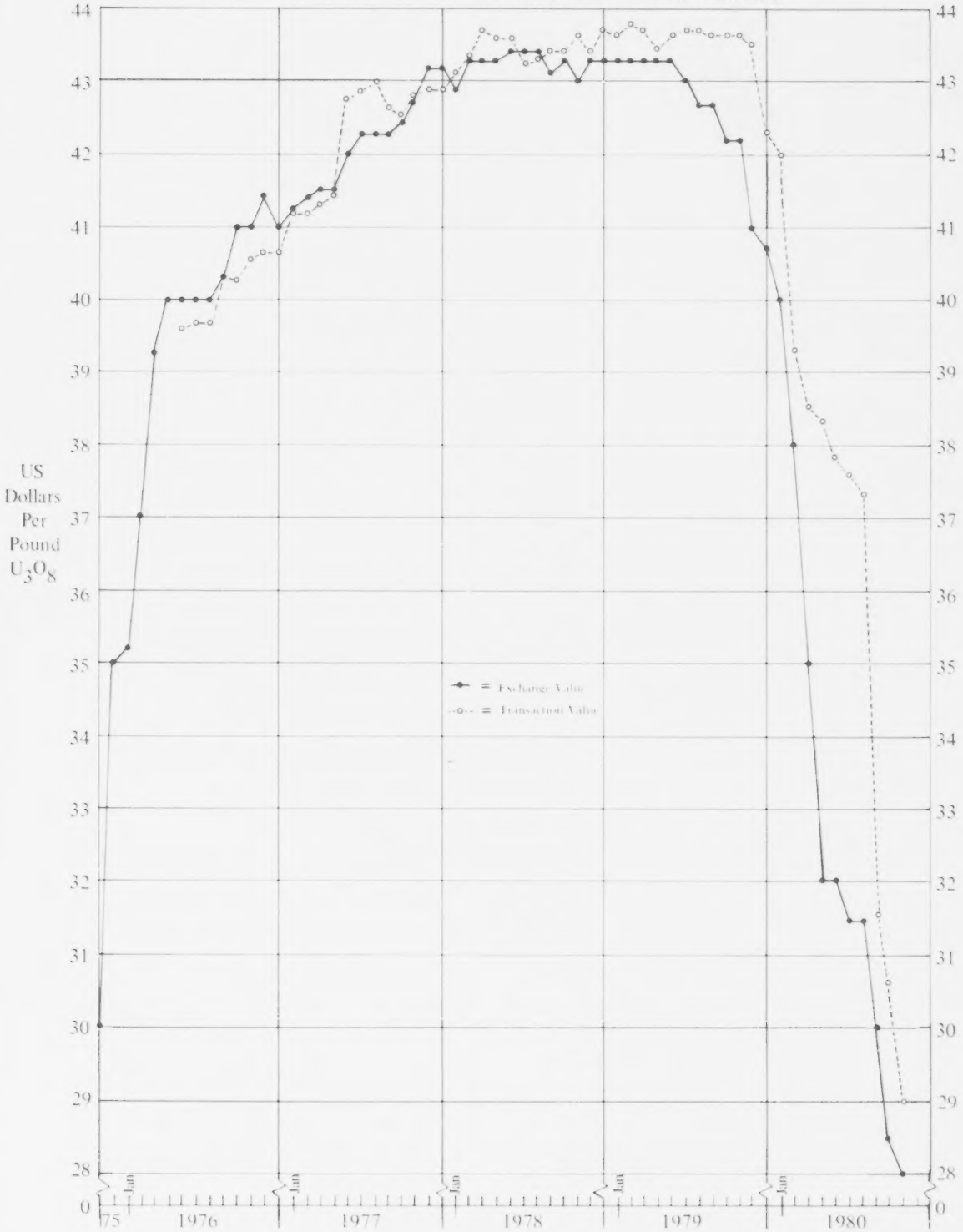
STATISTICAL DATA

EXCHANGE AND TRANSACTION VALUES SINCE NOVEMBER 1975

Determined as of the last day of the month indicated



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NUEXCO

STATISTICAL DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated

(US Dollars lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	–	–	–	–	–	–	–	6.35	6.35	6.40	6.45	6.50
1969	–	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00		

Note: See earlier Nuexco Reports for evolution of the definition of Exchange Value.

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated

(US Dollars lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	–	–	–	–	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00		

Note: See Nuexco Report 135 for a discussion of the definition of Transaction Value.

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STATISTICAL DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES*

Country	per lb U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates
US (dollar)	28.00	61.73	72.79
France (franc)	123.08	271.34	319.97
FRG (mark)	53.17	117.22	138.23
Japan (yen)	5,897	13,001	15,331
Switzerland (franc)	47.99	105.81	124.77
UK (pound)	11.46	25.27	29.80
Australia (dollar)	23.85	52.59	62.02
Canada (dollar)	32.97	72.68	85.71
Niger, Gabon (CFA)	6,154	13,567	15,999
South Africa (rand)	20.93	46.15	54.43

*Calculated using currency exchange rates published in the Wall Street Journal on the last Friday of the month.

LOAN USE CHARGE RATE—7.0% year

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

Derivation

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

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CURRENT TRANSACTIONS*

Nuexco Reference Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as percent of Current E.V.	Seller Group	Buyer Group	Remarks
1238	81	101 – 300	104	US	US	
1240	82-96	2000 – 4000	–	Australia	Europe	Definitive price information not available.
1266	80	0 – 50	101	US	US	
1267	80	101 – 300	100	Europe	Europe	
1269	81	601 – 1000	98	US	US	UF_6

*Transactions listed include not only those in which Nuexco was involved, but also all others of which Nuexco is aware.

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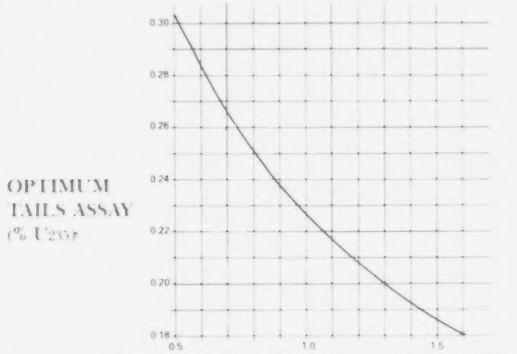
STATISTICAL DATA

OPTIMUM TAILS ASSAY

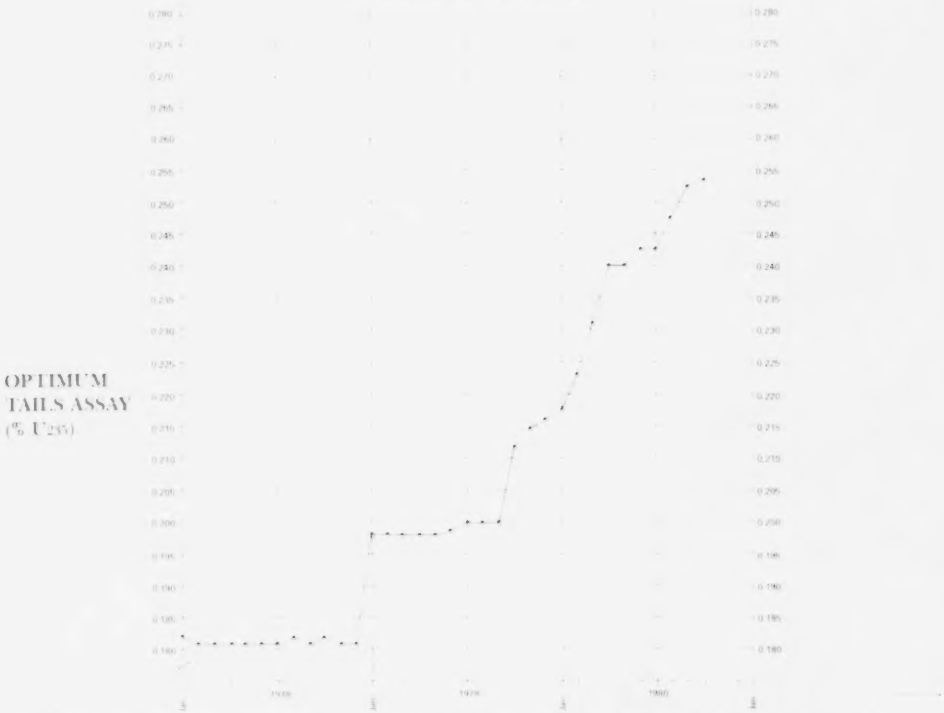
The optimum tails assay is the tails composition at which the cost of enriched uranium is lowest for given costs of separative work (SWU) and natural uranium feed. It depends only on the ratio of the cost of a kilogram of natural uranium in the form of UF_6 to the cost of a kilogram unit of separative work. The US Department of Energy (USDOE) Adjustable Fixed Commitment (AFC) enrichment contract holders have the option, within limits, to specify the transaction tails assay. The transaction tails assay for USDOE Requirements contracts is 0.2 percent U_{235}. For every one-hundredth of one percent increase in the transaction tails assay, uranium consumption increases about two percent.

TAILS ASSAY FOR MINIMUM COST OF PRODUCT*



*From NUEXCO Report 138

OPTIMUM TAILS ASSAY[1]



[1]Based on Exchange Value and USDOE AFC SWU price; interpolated to the nearest thousandth.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

	Producer Price Index—Industrial Commodities (1967 = 100)[1]	Consumer Price Index (1967 = 100)[2]	GNP Implicit Price Deflator (1972 = 100)[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]		
				Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)
Annual Avg. 1970[5]	110.0	116.3	91.36	3.88	3.87	3.69
Annual Avg. 1971[5]	114.1	121.3	96.02	4.12	4.15	3.97
Annual Avg. 1972[5]	117.9	125.3	100.00	4.56	4.59	4.26
Annual Avg. 1973[5]	125.9	133.1	105.80	4.84	4.98	4.51
Annual Avg. 1974[5]	153.8	147.7	116.02	5.44	5.63	4.88
Annual Avg. 1975[5]	171.5	161.2	127.15	6.13	6.24	5.39
Annual Avg. 1976[5]	182.4	170.5	133.71	6.76	6.87	5.91
Annual Avg. 1977[6]	195.1	181.5	141.70	7.28	7.67	6.43
Annual Avg. 1978[6]	209.4	195.4	152.05	8.23	8.56	7.02R
Annual Avg. 1979[6]	236.5	217.4	165.46	9.27	9.49R	7.60R
Jul 1979	237.5	218.9	–	9.33R	9.57	7.61R
Aug 1979	240.6	221.1	–	9.38	9.70	7.66R
Sep 1979	244.2	223.4	167.20	9.63	9.79	7.74R
Oct 1979	249.0	225.4	–	9.67	9.87	7.83R
Nov 1979	250.6	227.5	–	9.78R	9.85R	7.88R
Dec 1979	253.1	229.9	170.58	9.80	9.92	7.92R
Jan 1980	260.6	233.2	–	9.91R	10.06	7.97R
Feb 1980	265.9	236.4	–	9.92R	10.01	8.01R
Mar 1980	268.6R	239.8	174.48	9.90R	10.22R	8.05R
Apr 1980	270.7	242.5	–	10.00	10.30	8.12
May 1980	271.2	239.8	–	10.18	10.37	8.17
Jun 1980	273.0	247.6	178.93	10.13	10.69	8.24
Jul 1980	275.6	247.8	–	10.24	10.82	8.35
Aug 1980	277.3P	249.4	–	10.28P	10.78P	8.38P
Sep 1980	278.2P	251.7	182.92	–	–	8.48P

P = Preliminary R = Revised since last month

(1) US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

(2) US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

(3) US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

(4) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970–1976 are adjusted to the March 1977 benchmark. Data for January 1977 and beyond are adjusted to the march 1979 benchmark.

(5) Data for 1970–1976, monthly except for the GNP Implicit Price Deflator, and Price Index data for 1977–1978 appear on pages 4.6-4.8 of Nuexco Report 139.

(6) Employment and Earnings data for 1977–1979, monthly, appear earlier in this Report.

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US GOVERNMENT STATISTICS

(Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$))[1]

Metal Mining (SIC 10)

	1977	1978	1979
January	6.95	7.73	8.71
February	7.02	7.79	8.81
March	7.07	7.84	8.85
April	7.12	7.97	9.04
May	7.19	8.04	9.06
June	7.26	8.08	9.09
July	7.32	8.25	9.33
August	7.37	8.40	9.38
September	7.49	8.56	9.63
October	7.52	8.60	9.67
November	7.63	8.71	9.78
December	7.65	8.72	9.80
Annual Average	**7.28**	**8.23**	**9.27**

Primary Non-ferrous Metals (SIC 333)

	1977	1978	1979
January	7.16	8.24	9.00
February	7.20	8.28	9.01
March	7.24	8.27	9.11
April	7.34	8.32	9.48
May	7.37	8.36	9.14
June	7.71	8.56	9.43
July	7.83	8.62	9.57
August	7.78	8.66	9.70
September	8.01	8.74	9.79
October	8.07	8.83	9.87
November	8.12	8.86	9.85
December	8.15	8.97	9.92
Annual Average	**7.67**	**8.56**	**9.49**

(Chemicals and Allied Products (SIC 28))

	1977	1978	1979
January	6.19	6.78	7.33
February	6.20	6.82	7.33
March	6.23	6.84	7.37
April	6.30	6.87	7.52
May	6.33	6.94	7.48
June	6.39	6.97	7.54
July	6.47	7.05	7.61
August	6.49	7.06	7.66
September	6.57	7.14	7.74
October	6.62	7.20	7.83
November	6.66	7.23	7.88
December	6.73	7.29	7.92
Annual Average	**6.43**	**7.02**	**7.60**

(1) US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings Supplement, Revised Establishment Data, September 1980."

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STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

	Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1]	Weighted Average Minimum Weekly Wage Rates—Adult Males Australia Mining and Quarrying (A$)[2]
Annual Avg. 1970[3]	101.4	59.88
Annual Avg. 1971[3]	101.5	65.95
Annual Avg. 1972[3]	105.6	71.26
Annual Avg. 1973[3]	124.4	78.96
Annual Avg. 1974[3]	141.9	108.07
Annual Avg. 1975[3]	150.4	132.55
Annual Avg. 1976[3]	168.4	160.93
Annual Avg. 1977[3]	192.0	179.03
Annual Avg. 1978[3]	215.4	190.04
Annual Avg. 1979	248.5	196.34
May 1979	288.5	193.55
Jun 1979	294.9	196.65R
Jul 1979	298.2	199.22R
Aug 1979	293.2	200.29R
Sep 1979	302.4	201.07R
Oct 1979	309.4	200.53R
Nov 1979	310.4	199.87R
Dec 1979	319.4	200.68R
Jan 1980	340.1	215.67R
Feb 1980	345.6	215.13R
Mar 1980	340.3	214.76R
Apr 1980	327.9	215.06R
May 1980	335.1	214.66R
Jun 1980	338.4	213.99R
Jul 1980	349.1P	221.26P
Aug 1980	353.2P	—

P = Preliminary R = Revised since last month

(1) Australian Bureau of Statistics, Canberra; "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.
(2) Australian Bureau of Statistics, Canberra; "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.
(3) Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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STATISTICAL DATA

CANADIAN GOVERNMENT STATISTICS

	Industry Selling Price Index: Manufacturing (D 500000)[1,2] (1971 = 100.0)	Wage-earner Data: Average Hourly Earnings (C$)[3,4]		
		Metal Mining, including milling (SIC 050-059)	Primary Metal Industries, non-ferrous (SIC 296-298)	Chemicals and Chemical Products (SIC 370-379)
Annual Avg. 1977	174.3	8.18	6.50	6.51
Annual Avg. 1978	190.4	8.76	6.82	6.97
Annual Avg. 1979	217.9	9.60	7.35	7.67
Jun 1979	216.0	9.49	7.27	7.66
Jul 1979	218.3	9.37	7.34	7.73
Aug 1979	220.0	9.56	7.38	7.77
Sep 1979	223.4	9.75	7.50	7.81
Oct 1979	227.4	9.89	7.54	7.88
Nov 1979	228.1	9.97	7.61	7.91
Dec 1979	230.4	9.93	7.51	7.89
Jan 1980	239.0	9.96	7.57	7.99
Feb 1980	240.8	10.11	7.69	8.08
Mar 1980	239.5	10.34	7.83	8.26
Apr 1980	241.1	10.40	7.94	8.36
May 1980	242.3R	10.50	8.01	8.44
Jun 1980	243.6R	10.33P	8.07P	8.46P
Jul 1980	246.0	10.45P	8.10P	8.53P
Aug 1980	248.6P	—	—	—

P = Preliminary R = Revised since last month

(1) Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

(2) Monthly data for 1973 through 1978 appear on page 4.10 of Nuexco Report 138.

(3) Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

(4) Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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REPUBLIC OF SOUTH AFRICA STATISTICS

	Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Consumer Price Index[2] (1975 = 100, except where otherwise indicated)
Annual Avg. 1970[3]	7.34	100.3[4]
Annual Avg. 1971[3]	7.88	106.4[4]
Annual Avg. 1972[3]	8.79	113.3[4]
Annual Avg. 1973[3]	10.51	124.1[4]
Annual Avg. 1974[3]	13.18	138.5[4]
Annual Avg. 1975[3]	16.71	157.2[4]
Annual Avg. 1976[3]	19.30	174.7[4]
Annual Avg. 1977[3]	23.87	194.4[4]
Annual Avg. 1978[3]	27.14	137.2
Annual Avg. 1979[3]	30.18	155.3
Jul 1979	–	157.9
Aug 1979	–	160.2
Sep 1979	30.71	162.1
Oct 1979	–	162.9
Nov 1979	–	163.4
Dec 1979	31.89	164.0
Jan 1980	–	165.4
Feb 1980	–	167.0
Mar 1980	33.65	168.0
Apr 1980	–	170.0
May 1980	–	171.9
Jun 1980	34.08	174.6
Jul 1980	–	177.2
Aug 1980	–	179.2
Sep 1980	–	182.8

(1) Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
(2) Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
(3) Historical data for 1970 through 1979 appear on page 19 of Nuexco Report 140.
(4) April 1970 = 100.00

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

URANIUM SUPPLY

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U_3O_8) 0 to 1 Year	1 to 2 Years	2 to 3 Years	Remarks
Available for Sale:				
1286	150	150	150	Long term
1392	200			
1394	1000			UF_6
1475	1000			UF_6
1480	500			
1481	250			
1490	1250			
1496	300			
1533	400			UF_6
1539	200			
1540	750			UF_6
1547	100			
1550	1000			UF_6
1551	150			
1552	200			
TOTALS	7450	150	150	
Available for Loan:				
1355	600			
1429	500			
1492	900			UF_6
1520	1000			UF_6
1531	500			UF_6
TOTAL	3500			

***Measured from the date of this Report.**

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the uranium market to buy, sell, borrow or lend. The data presented in this section are in no way intended to be indicative of the entire uranium market for the time period covered.

URANIUM DEMAND

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U_3O_8) 0 to 1 Year	1 to 2 Years	2 to 3 Years	Remarks
Inquiries to Purchase:				
1408	150			
1459		200	200	Long term
1462			100	Long term
1488	100			
1489	200			
1497	500			
1508	150			
1529			550	Long term
TOTALS	1100	200	850	
Inquiries to Borrow:				
1553	900			
TOTAL	900			

**Measured from the date of this Report.

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MARKET OPPORTUNITIES

Market Opportunities are *active* inquiries in the secondary market for UF_6 conversion services. The data presented in this section are in no way intended to be indicative of the entire market for the time period covered.

CONVERSION SUPPLY

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U as UF_6)			Remarks
	0 to 1 Year	1 to 2 Years	2 to 3 Years	
1394	850			
1424	850			
1450	850			
1451	150			
1475	850			
1533	350			
1540	650			
TOTAL	4550			

CONVERSION DEMAND

Nuexco Reference Number	Delivery Period* (Thousands of Pounds U as UF_6)			Remarks
	0 to 1 Year	1 to 2 Years	2 to 3 Years	

*Measured from the date of this Report.

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Erratum

Table 6 of Report 147 (November, 1980) contained a systematic error. A corrected version of Table 6 is printed below.

Table 6

NUCLEAR GENERATION CAPACITY FORECAST FOR 1990
(thousands of megawatts)

	EIA[1] (Low-High)	Nuexco
OECD Countries		
Australia New Zealand	-0-	-0-
Austria Switzerland	2.9-2.9	1.9
Benelux Denmark	6.0-6.0	5.9
Canada	13.1-11.2	13.6
France	38.5-11.2	18.2
Germany	22.5-27.5	22.5
Greece Turkey	-0-	0.6
Italy	3.1-1.3	1.3
Japan	24.5-30.9	29.9
Scandinavia	12.6	11.6[2]
Spain Portugal	9.3-13.2	11.1
United Kingdom Ireland	11.6-13.1	10.9
Subtotal	115-170	161
United States	121-139	112
Non-OECD Countries		
Argentina	1.5-2.1	0.9
Brazil	1.9-3.1	3.1
India	1.9-2.1	1.7
South Korea	5.5-7.1	7.2
Mexico	1.3-2.6	1.3
Pakistan	0.1-0.7	0.1
Philippines	0.6-0.6	0.6
South Africa	1.8-2.7	1.8
Taiwan	1.9-6.7	1.9
Yugoslavia	0.6-1.2	0.6
Subtotal	20-30	22
TOTAL	286-339	298

[1]Source: 1979 Annual Report to Congress, Energy Information Administration, Volume 3, pages 31 and 108.
[2]Includes, for purposes of comparison, two reactors fueled by the USSR.